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Appendix

We describe the model settings and system dynamics for this study's life time disability by diabetes

status.

During each 1-year interval, individuals can move into and from one of the four states: remaining not

disabled, disability, recovery from disability, and death. Because of the high remission rates (i.e.,

recovery from disability) observed in the data, a state of "recovery from disability" was created in the

model to describe the status wherein individuals were disabled in year t and recovered in year t+1.

Almost all of the individuals who had a second episode of disability remained disabled until death or to

the end of follow-up. Therefore we assumed once those in the "recovery from disability" state returned

to the disabled state a second time, they stayed in disability until death.

The Markov chain of the model is illustrated in Figure 1 in the manuscript.

Below we first elaborate the parameter setting of the model and then describe the Markov model. Note
all the model parameter settings in this section are by sex and diabetes status cohort.

Let a be the age of some population. We consider the adult population from 50 to 100 years old.

$X(a)$ = the proportion of the population in the "remaining Non-Disabled" state at age = a

$X_0(a)$ = the proportion of the population in the "Recovered from Disability" state at age = a

$Y_0(a)$ = the proportion of population in "Disability" state at age = a

$D(a)$ = the proportion of population in "Death" state at age = a

$i(a)$ = Annual incidence probability of disability at age a.

$r(a)$ = Annual recovery probability of disability at age a.

$\delta_x(a)$ = Annual "Non-Disability" mortality probability at age a.

$\delta_y(a)$ = Annual "Disability" mortality probability at age a.

According to the following assumptions,

1 the incidence of disability among non-disabled respondents at certain ages are the same regardless of
their disability history

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2 the mortality for non- disabled respondents at certain ages are the same regardless of their disability history

3 the mortality for short term disability and permanent disability at certain age are the

The transition probability matrix P is

$$
\begin{bmatrix}
1-i(a)(1-\delta_x(a))-\delta_x(a) & i(a)(1-\delta_x(a)) & 0 & 0 & \delta_x(a) \\
0 & 0 & r(a)(1-\delta_y(a)) & (1-r(a))(1-\delta_y(a)) & \delta_y(a) \\
0 & i(a)(1-\delta_x(a)) & 1-i(a)(1-\delta_x(a))-\delta_x(a) & 0 & \delta_x(a) \\
0 & 0 & 0 & 1-\delta_y(a) & \delta_y(a) \\
0 & 0 & 0 & 0 & 1
\end{bmatrix}
$$

Let $S = [x \quad x_0 \quad y_0 \quad y \quad d]$ be a vector of the system states, Then,

$$S(a+1) = S(a)P(a)$$

The Life expectancy is the expected value of the conditioned death distribution

$$LE = \frac{\sum_a a * Prob(death\ at\ age\ a)}{Prob(death)}$$

$$= \frac{\sum_a a * [D(a+1) - D(a)]}{\sum_a [D(a+1) - D(a)]}$$

where $\sum_a [D(a+1) - D(a)] = 1$,

With the consideration of half year cycle adjustment

$$LE = \sum_a a * [D(a+1) - D(a)] + 0.5$$

The remaining life expectancy

$$remining\ LE = LE - a'$$

where a' is the starting age.

By running the Markov model from the starting age and ending at age=100, we obtained the onset of disability, non-disability life years and disability life years as follows.

Here we define average non-disability life year LYN to be

$$LYN = \sum (X(a)+X_0(a))$$

The average disability life year LYD is defined as

$$LYD = \sum (Y(a)+Y_0(a))$$

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To include half year cycle adjustment

$$LYN = \sum (X(a)+X_0(a)) + 0.5$$

The average onset is defined as

$$a' + LYN$$

Confidence intervals were computed by sampling the incidence probabilities, recovery probabilities and mortality probabilities from the statistical models.

Table 1— Incidence (annual % and 95% confidence interval) of major sources of morbidity affecting disability-free life years among U.S. men and women with and without diabetes.

	Men		Women	
	Diabetes	No Diabetes	Diabetes	No Diabetes
Disability Incidence				
Severe Mobility loss	3.2** (3.0, 3.5)	1.7 (1.6, 1.8)	4.9** (4.5, 5.3)	2.6 (2.4, 2.7)
IADL	3.4** (3.1, 3.7)	2.3 (2.1, 2.4)	4.6** (4.3, 5.0)	2.7 (2.5, 2.8)
ADL	3.7** (3.4, 4.1)	2.3 (2.2, 2.4)	5.0** (4.7, 5.4)	2.9 (2.8, 3.0)
Mortality Rate	4.0** (3.7, 4.3)	2.8 (2.7, 2.9)	3.8** (3.6, 4.1)	2.5 (2.3, 2.6)
Disability Remission*				
Severe Mobility loss	19.9** (17.8, 22.0)	23.3 (21.5, 25.0)	19.1 (17.3, 20.9)	20.9 (19.8, 22.0)
IADL	22.3 (20.5, 24.2)	23.3 (22.0, 24.7)	16.7 (15.2, 18.3)	18.2 (17.0, 19.5)
ADL	22.0** (20.2, 23.7)	25.3 (24.0, 26.6)	18.9** (17.6, 20.3)	22.3 (21.2, 23.4)

*Estimated among persons with incident disability

**p-value <0.01 between those with and without diabetes within sex

ADL: Activities of daily living

IADL: Instrumental activities of daily living

Note: all models were adjusted for age, race/ethnicity, prevalent CVD, and sex